CALIFORNIA DIVISION OF MINES AND GEOLOGY

FAULT EVALUATION REPORT FER-240
Supplement No. 1

Review of New Data on the San Jacinto and Lytle Creek Faults, Devore Quadrangle, San Bernardino County, California

by

Earl W. Hart
March 8, 1995

INTRODUCTION

The purpose of this supplement is to review new reports by LOR Geotechnical Group (1994) and Geosoils, Inc. (1994) to re-assess the proposed zoning recommendations contained in FER-240 (Burnett and Hart, 1994). These consulting reports, which contain extensive new trench data on the San Jacinto and Lytle Creek Faults in the Devore quadrangle, were received after the preparation of FER-240 and the issuance of the Preliminary Review Map of Earthquake Fault Zones, Devore quadrangle (CDMG, 1994), that proposes revision of an earlier Official EFZ map (CDMG, 1974).

SUMMARY OF DATA

LOR Report (1994)

This report, filed with CDMG as AP 2800, summarizes the fault investigation of a large site in Sycamore Flat that straddles the San Jacinto Fault Zone (Figure 1). LOR excavated 8400 feet of trenches, which locally identified an active trace of the San Jacinto Fault. This report documents the findings with detailed trench logging, soil stratigraphy and radiocarbon age-dating of alluvium. Preliminary and partial results of this study were made available by Jeff Johnston of LOR (letter of 6/14/94) to Burnett and Hart (1994), who used the data to help locate the active trace of the San Jacinto Fault in the northwestern part of Sycamore Flat.

The approximate locations of LOR's 18 trenches are plotted on Figure 1. The locations of Holocene and possible Holocene faults are plotted in red and show the trends of these recently active faults. The ages of faulting were based on the estimated ages of soil development and grussification of cobbles using a limited number of radiocarbon-dated burned-wood samples for control.

The youngest and best-defined fault was exposed in the northwestern part of Sycamore Flat by trenches T-1, T-2, T-7, and T-8. These trenches expose a relatively narrow zone of northwest-trending, vertical to steeply northeast-dipping faults in late Quaternary alluvium. The youngest faulted units are dated by radiocarbon methods as 490±70 ybp (trench T-2) and 650±130 ybp (trench T-7). The fault is better developed in older Holocene and late Pleistocene(?) units, indicating previous rupture events. A mismatch of stratigraphic units indicates the main sense of displacement is strike-slip. The fault generally aligns with a weak tonal lineament (see Burnett and Hart, 1994) and the fault plotted on the Preliminary Review EFZ Map (CDMG, 1994)
(Figure 1).

The Holocene fault of LOR was not observed in either younger or relatively older (Holocene?) alluvium exposed in the 30-foot deep trench T-6 that was on trend and less than 300 feet to the southeast of T-8 (Figure 1). LOR does not comment on this. However, 2000 feet to the southeast, trench T-11 exposes a 127-foot wide zone of steeply-dipping, northwest-trending Holocene faults that offset alluvium radiocarbon dated as young as 2540±140 ybp. The southwest branch fault, shown as largely concealed on the 1974 Official EFZ Map, was not reported in trenches T-6, T-11 or T-12 (Figure 2).

Evidence of Holocene faulting in the southeastern part of Sycamore Flat is more equivocal in the LOR trenches as the area has a higher water table, thinner Holocene units, and has been extensively graded. LOR did identify faults and fractures in undated "older alluvium" and locally in younger alluvium (trenches T-13, T-14, T-16, and possibly T-17), but the faults did not align from one trench to another and seemed to suggest a broad zone of faults at least 600 feet wide. Although this zone centers on the faults shown on the Preliminary Review Map (Figure 1) and has modest evidence of Holocene activity, a dominant through-going Holocene fault is not evident from the LOR trench logs.

Geosoils Report (1994)

This report, filed with CDMG as AP 2808, is a feasibility investigation of a 3,586-acre site in the Lytle Creek Wash. The report evaluated numerous strands of the San Jacinto and Lytle Creek Faults mapped or inferred by various geologists, including those shown on the 1974 EFZ map of the Devore Quadrangle. Geosoils logged approximately 19,840 lineal feet of cut faces in gravel pits (G&S #1,2,3), excavated and logged 3,855 feet of trenches (T-1 to T-7), reviewed 2,775 feet of previously excavated trenches of Eberhart and Stone (ES trenches), and excavated 785 feet of trenches to "calibrate" the ES trenches(G-T trenches). The locations of these excavations and locations of

possible Holocene faults are shown on Figures 1 and 2. Although the excavations were extensive, there were many faults to evaluate on this large site (i.e., the site was only partly evaluated) and some of the trenches did not extend below late or mid-Holocene alluvium.

In brief, the Geosoils report provided evidence that 1) one or both traces of the San Jacinto Fault just south of Sycamore Flat (Figure 1) are Holocene active and 2) there was no evidence to indicate that any of the fault strands shown on Figure 2, with the exception of the easternmost trace of the San Jacinto Fault near Sycamore Flat, are active.

Three concealed traces of the Lytle Creek Fault shown on the 1974 EFZ map (Figure 2) are tested by trenches T-2 and T-6 and the G&S #1 open pit excavation. The trenches exposed unbroken late Holocene (T-6) and mid-Holocene (T-2) alluvial deposits to a depth of 12 or 13 feet across two of the strands. Pit G&S #1 was excavated in Pleistocene alluvium, which also showed unbroken alluvium across two fault strands (Figure 2). Pit G&S #2 also showed unbroken Pleistocene deposits, although no faults were inferred in that area.

Pit G&S #3 showed no evidence of the concealed fault projected between the San Jacinto and Lytle Creek Faults (Figure 2). However, logging revealed previous unknown faults in late Pleistocene alluvium at the west end of the deep pit. The faults occur as a N60°W-trending zone as much as 120 feet wide and mostly with steep southwest dips. The faults offset late Pleistocene alluvium over a vertical range of 80 feet and "appeared to die out [upward] in Holocene/Latest Pleistocene sediments" estimated to be 8,000 to 18,000 ybp by Geosoils. According to Roy Shlemon (Appendix B of Geosoils, 1994), the unbroken overlying alluvium was estimated to be 5,000 to 7,000 ybp based on soil-stratigraphy.

In the Sycamore Flat area, Geosoils' Trench T-7 clearly shows a tectonic graben in which Holocene alluvium has been downdropped into older (Pleistocene) alluvium and bedrock. A sample of charcoal at a depth of 12 feet in the graben was radiocarbon-dated at 90±45 ybp. The graben is bounded by shears that trend N48°W, although Geosoils' geologic map (their Plate 2) shows the fault to have a N20°W trend and to connect with probable Holocene faults identified in their T-8 and the east end of Eberhart and Stone's trench ES3. The young faults identified on these logs appear to form an incompletely defined zone at least 100 feet wide that roughly coincides with the faults shown on the Preliminary EFZ map (Figure 1). No log was provided for ES20, which appears to cross the main trace on Figure 1.

Numerous additional faults and fractures were identified in older alluvium and bedrock to the southwest of the Holocene

traces, but none of these ruptures are shown to offset Holocene units. Some of these older faults approximate the fault traces shown on the existing EFZ map (Figure 2).

In the southeastern part of the Devore quadrangle, Geosoils dug three additional trenches. Their 600-foot trench T-6 was intended to intercept concealed faults previously zoned by CDMG (Figure 2). It was also placed to intercept the northwest projection of the fault mapped by Rassmussen and Assoc. (1992) at the El Rancho Verde Country Club. No faults were observed in this 14- to 17-foot deep trench, although only late Holocene and, locally, mid to late Holocene alluvium was exposed in the trench. Nonetheless, it provides some support for the proposed zone revisions shown on Figure 1.

Trenches T-4 and T-5, just north of El Rancho Verde Country Club, were placed to intercept northwest-trending concealed and inferred faults of CDMG (1974; see Figure 2) and others. No faults were reported by Geosoils in the 12 to 14-foot deep trenches in mid to late Holocene alluvium. The trenches also partly bracketed the zone of tonal lineaments mapped by Burnett and Hart (1994), which were used to help position the EFZ boundary in this area (Figure 1). However, the trenches do not overlap and cannot rule out an active fault that map pass between them -- particularly if the faults have a northerly trend or are right-stepping.

AIRPHOTO INTERPRETATIONS

The U.S. Department of Agriculture (1952-53) AXL 1:24,000 scale and USGS (1967) WRD 1:12,000 scale airphotos were rechecked in the trenched and excavated areas and the following observations were made:

1. No tonal lineament or geomorphic feature was observed near the late Pleistocene to early Holocene(?) fault at the west end of gravel pit G&S #3. Although these photos pre-date the sand and gravel mining in this area, the ground surface was broadly furrowed and disturbed (for unknown purposes) prior to January 1953.

2. The weak tonal features (inferred faults on Figure 1) in the vicinity of Geosoils trenches T-4 and T-5 are reconfirmed on the USDA photos, although it is recognized that these features could be buried stream channels or even artificial features rather than faults.

3. The northwest-trending linear drainage, topographic saddle, and tonal lineament identified by Burnett and Hart (1994) and shown as the main trace of the San Jacinto Fault on Figure 1 is reconfirmed on the USDA and USGS airphotos.

The trenching of Geosoils and LOR partly coincides with this alignment.

CONCLUSIONS AND DISCUSSION

The recent trenching investigations of LOR (1994) and Geosoils (1994) are largely consistent with the revised fault locations of Burnett and Hart (1994) and the resultant Preliminary Review Maps of proposed revisions of Earthquake Fault Zones in the eastern part of the Devore quadrangle (Figure 1). These reports verify the location of the active trace of the San Jacinto Fault in the Sycamore Flat area and the absence of the southeast extensions of the Lytle Creek and most branches of the San Jacinto Faults (Figures 1 and 2).

Trenching north of El Rancho Verde Country Club (Geosoils trenches T-4 and T-5, Figure 1), while suggestive of the absence of late Holocene faulting (or even mid-Holocene faulting locally), is not adequate to dismiss a possible connection between active traces of the San Jacinto Fault to the north and south (see Map 2a of Burnett and Hart, 1994).

RECOMMENDATION

Based on this evaluation, no changes are recommended in the proposed Earthquake Fault Zones shown on the 12/1/94 Preliminary Review Map of the Devore quadrangle.

Report Prepared by:

Earl W. Hart

Earl W. Hart
Senior Geologist
CEG 935

Report reviewed and recommendation approved
William A. Bryant
CEG #1554

REFERENCES CITED

Burnett, J.L., and Hart, E.W., 1994, Holocene faulting on the Cucamonga, San Jacinto, and related faults, San Bernardino County, California: California Division of Mines and Geology Fault Evaluation Report FER-240 (unpublished).

California Division of Mines and Geology, 1974, Official Map of Earthquake Fault (Special Studies) Zones, Devore quadrangle: California Division of Mines and Geology, July 1, 1974

California Division of Mines and Geology, 1974, Preliminary Review Map of December 1, 1994, Earthquake Fault Zones, Devore quadrangle, California Division of Mines and Geology

Geosoils, Inc., 1994, Preliminary geologic investigation, proposed master plan development, The Villages at Lytle Creek, Lytle Creek Development, San Bernardino County, California: Unpublished consultant's report W.O. 1590A.1-AV, 3 volumes, 10/31/94, with supplement of Feb. 15, 1995; includes Appendix B (Geopmorphic and soil-stratigraphic age assessments by Roy J. Shlemon)(AP 2808).

LOR Geotechnical Group, 1994, Geologic fault investigation, Sycamore Flats area, San Bernardino County, California, RTC Contract #0760-93-0090: Unpublished consultant's report, Project No. 60562.3, Sept. 30, 1994, with supplement of Dec. 19, 1994 (AP 2800).

Note: See FER-240 for additional references.